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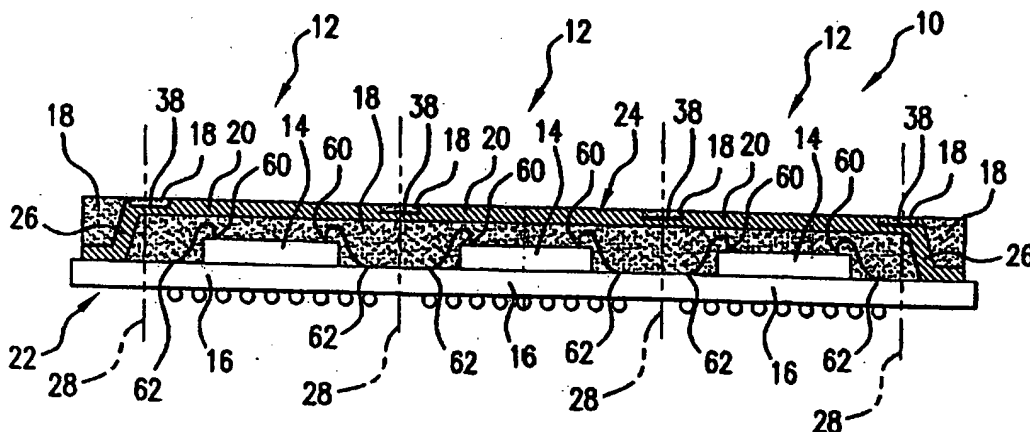
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(54) Title: **THERMAL ENHANCED PACKAGE FOR BLOCK MOLD ASSEMBLY**



(57) Abstract: A heat spreader (20) is added to a package to enhance thermal and advantageously electrical performance. In manufacture, a heat spreader precursor (24) is advantageously placed over a group of dies and secured after bonding (e.g., wire or tape bonding or flip-chip bonding) and before matrix/block mold. For example, a package strip (10) may consist of a row (linear array) of groups of die attach areas (e.g. in a rectangular array of four). The heat spreader precursor (20) may accommodate one such group or multiple groups along the package strip (10). The package strip (10) may then be singulated to form the individual packages. Each singulated package includes a die (14), its associated substrate 16 (e.g., either a lead frame or interposer type substrate) and a portion of the heat spreader precursor (24) as a heat spreader (20).

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US03/29569

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : H01L 23/02, 21/44, 21/48, 21/50

US CL : 257/660-678

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 257/660-678, 705-707, 713, 720, 734-784, 787, 796; 438/51, 55, 64, 106, 112, 113, 122, 123, 127

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Please See Continuation Sheet

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EAST

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,608,267 A (MAHULIKAR et al) 04 March 1997 (04.03.1997), see entire document.	1-25
Y	US 5,970,310 A (BANKS et al) 19 October 1999 (19.10.1999), see entire document.	1-25
X	US 6,432,742 B1 (GUAN et al) 13 August 2002 (13.08.2002), see entire document.	1-25
X	US 6,432,749 B1 (LIBRE) 13 August 2002 (13.08.2002), see entire document.	1-25
X	US 5,367,196 A (MAHULIKAR et al) 22 November 1994 (22.11.1994), see entire document.	1-25
X	US 6,432,752 A (FARNWORTH) 13 August 2002 (13.08.2002), see entire document.	1-25
X	US 5,650,663 A (PARTHASARATHI) 22 July 1997 (22.07.1997), see entire document.	1-25
A	US 5,919,329 A (BANKS et al) 06 July 1999 (06.07.1999), see entire document.	1-25
A	US 5,905,632 A (SETO et al) 18 May 1999 (18.05.1999), see entire document.	1-25

☒ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

* Special categories of cited documents:

"A"	document defining the general state of the art which is not considered to be of particular relevance	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"B"	earlier application or patent published on or after the international filing date	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O"	document referring to an oral disclosure, use, exhibition or other means	"&"	document member of the same patent family
"P"	document published prior to the international filing date but later than the priority date claimed		

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C. (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5,977,626 A (WANG et al) 02 November 1999 (02.11.1999), see entire document.	1-25
A	US 6,057,601 A (LAU et al) 02 May 2000 (02.05.2000), see entire document.	1-25
A	US 6,359,341 B1 (HUANG et al) 19 March 2002 (19.03.2002), see entire document.	1-25
A	US 6,409,859 B1 (CHUNG) 25 June 2002 (25.06.2002), see entire document.	1-25

INTERNATIONAL SEARCH REPORT

International application No.

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Box I Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)

This international report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claim Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claim Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claim Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of Item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
Please See Continuation Sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☒ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐
☐

- The additional search fees were accompanied by the applicant's protest.
- No protest accompanied the payment of additional search fees.

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BOX II. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING

Group I, claims 1-13, draw to a DEVICE, classified 257, and subclass 678.

Group II, claims 14-25, draw to a method for manufacturing packaged semiconductor devices, classified 438, and subclass 106.

This International Searching Authority considers that the international application does not comply with the requirements of unity of invention (Rules 13.1, 13.2 and 13.3) for the reason indicated below:

The device of group I is different from group II because the Group I deals with a product/device comprising a substrate having first and second generally opposite surfaces, a die mounted to the surfaces, a molding compound encapsulating the die, heat spreader at least partially embedded in the molding compound; and the Group II deals with a method for manufacturing packaged semiconductor devices comprising disposing a plurality of dies onto a plurality of interconnected substrate; electrically connecting I/O pads on each die; securing a plurality of interconnected heat spreaders; over molding the plurality of dies, the bond sites, and the plurality of interconnected heat spreaders with a continuous coating of molding compound to form a plurality of interconnected package precursors.

Continuation of B. FIELDS SEARCHED Item 2:

Lau et al, Electrical Design of a Cost-Effective Plastic GBA Package, IEEE Part B, vol. 21, NO.1, 2/1998.

P. Scharf, T. Coleman and K. Avellar, "Flip Component Technology", IEEE Electronic Component Conference (1967), pp. 269-274. R.

Lachance, H. Lavoie, A Mountanari, "Corrosion/Migration Study of Flip Chop Unterfill and Ceramic Overcoating", IEEE Electronic Component and Technology Conference (1997), pp. 885-889.